

NOAA TESTBED

news

LINKING RESEARCH & OPERATIONS TO IMPROVE WEATHER FORECASTS FOR THE NATION

What's *news* at NOAA Testbeds

The NOAA USWRP Executive Committee (NUEC) hosted the 2nd NOAA Testbed Workshop at the Earth System Research Laboratory (ESRL) from 4-5 May 2010 in Boulder, CO. The workshop brought together 80 experts from testbeds to compare experiences and lessons learned. There is no other such meeting of people who have helped build testbeds over the last several years. This workshop was an important opportunity for a wide variety of testbed projects to build cross-testbed collaborations and exchange information, lessons-learned, and best practices. Participants included researchers from across NOAA, the National Center for Atmospheric Research, and NASA; representing the Joint Hurricane Testbed (JHT), Hydrometeorology Testbed (HMT), Hazardous Weather Testbed (HWT), Developmental Testbed Center (DTC), Climate Testbed (CTB), Societal Impacts Program (SIP), and the Short-term Prediction Research and Transition Center (SPoRT). There was a consensus that the workshop was useful to participants, and that they would take back best practices to help manage and optimize the efforts in their respective testbeds. Most important was the recommendation that results from

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tJet Making Hurricane Predictions Faster

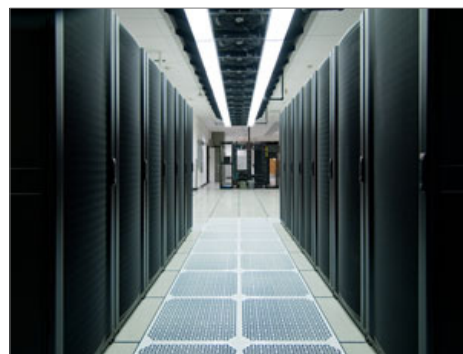
During the week of August 15, ESRL's newest supercomputer "tJet" entered acceptance testing and went into operation. tJet will be vital to NOAA's Hurricane Forecast Improvement Project that aims to more accurately forecast tropical storms, hurricane intensity and tracking as well as the dangerous storm surges related to hurricanes.

NOAA is dependent on highly reliable and resilient high-performance computing facilities to process large model runs and data assimilation experiments for the improvement of weather forecasts. tJet, one of NOAA's largest supercomputers, is a major upgrade to the existing capabilities hosted by ESRL. Based on the processor technology of its predecessor nJet, tJet's features have been compacted to offer a much higher compute capacity with approximately 10,032 cores vs. the previous 3,520 cores. This means that high-resolution models such as the Hurricane Weather Research and Forecasting System can be run at a higher resolution than currently. Additionally, the more

powerful system can now deliver real-time research forecasts to the hurricane forecasters of the National Weather Service faster and with better accuracy.

tJet is supported by NOAA's funding for hurricane research that quadrupled in 2009 to increase hurricane observations, advance forecast models through research, development, and engineering, increase computing power, and enhance collaboration with hurricane scientists in the private sector, government, and universities to advance research and operations.

– Craig Tierney, NOAA/ESRL





David Skaggs Research Center, Boulder, CO

multiple testbeds have implications for future NOAA planning regarding major observing system investments, and that these results should be considered in future planning.

The workshop also provided a unique opportunity to share a wide range of approaches and experiences for transitioning new methods or tools into forecast operations based on individual testbed needs. Workshop participants were in favor of holding another workshop next year that will focus on generating input for NOAA's out-year planning process. In addition, new collaborations were formed across Testbeds, such as between HMT and SPoRT, and new awareness of

the potential for the ALPS Workstations to help with AWIPS-like product testing, was realized.


Another outcome of the meeting was a recommendation to create a simple "Testbed Portal" web site where brief descriptions of the key NOAA-focused testbeds could be found, as well as links to each Testbed's home page. This portal is now live on the USWRP web page.

New


NOAA Testbed Portal

<http://www.esrl.noaa.gov/research/uswrp/testbeds/>


Welcome to the NOAA Testbed Portal




Climate Testbed – NOAA has formed the Climate Test Bed (CTB) to accelerate the transfer of research and development into improved NOAA operational climate forecasts, products, and applications. The CTB will routinely serve as a conduit between the operational, academic and research communities. This facility is located at the National Centers for Environmental Prediction in Camp Springs, MD. CTB personnel include scientists from NCEP and from other NOAA and non-NOAA organizations participating in the CTB.




Developmental Testbed Center – Begun in 2003 with support from USWRP and NCAR, the DTC's mission is to accelerate the improvement in weather forecasts by facilitating the transition of the most promising new NWP techniques from the research community into operations. The DTC, currently located jointly at NCAR and NOAA Earth Systems Research Laboratory, fulfills its mission by performing extensive retrospective tests of new capabilities in the Weather Research and Forecasting (WRF) community model, as well as supporting the addition of new capabilities to the WRF code base from the academic community through its visitor program. The DTC is currently in the process of expanding its community code support and testing to include the application of WRF to hurricanes and the Gribpoint Statistical Interpolation (GSI) data assimilation system.



Hydrometeorology Testbed – HMT was established in 2003 to address scientific and practical challenges associated with extreme precipitation, including a key focus of USWRP – to improve quantitative precipitation forecasting (QPF). HMT's aim is to accelerate the development and prototyping of advanced hydrometeorological observations, models, and physical process understanding, and to foster infusion of these advances into forecasting operations of the NWS, and to support the broader user community's needs for 21st Century precipitation information. HMT addresses these requirements through innovation, demonstration and infusion. Major activities focus on QPF, QPF, snow information, hydrologic impacts, climate, and decision support tools. HMT's regional implementations started in California, have been extended to the Pacific Northwest, and are beginning in the Southeast. HMT is led by NOAA/ESRL's Physical Sciences Division with partners across NOAA, other agencies and universities.



Hazardous Weather Testbed – NOAA's Hazardous Weather Testbed (HWT) develops, tests and evaluates techniques to improve NWS severe weather forecast and warnings. The HWT is a joint facility managed by the National Severe Storms Laboratory (NSSL), the Storm Prediction Center (SPC), and the NWS Oklahoma City/Norman Weather Forecast Office (OUN) located at the National Weather Center in Norman, Oklahoma. The HWT facilities include a combined forecast and research area placed between the operations areas of the SPC and OUN, and the NSSL Development Lab located nearby. Researchers, forecasters and developers use these facilities to evaluate new platforms and techniques, using past data and during real-time operations. Collaboration among these diverse groups provides valuable feedback that can immediately be applied to the research and development process, streamlining technology transfer.



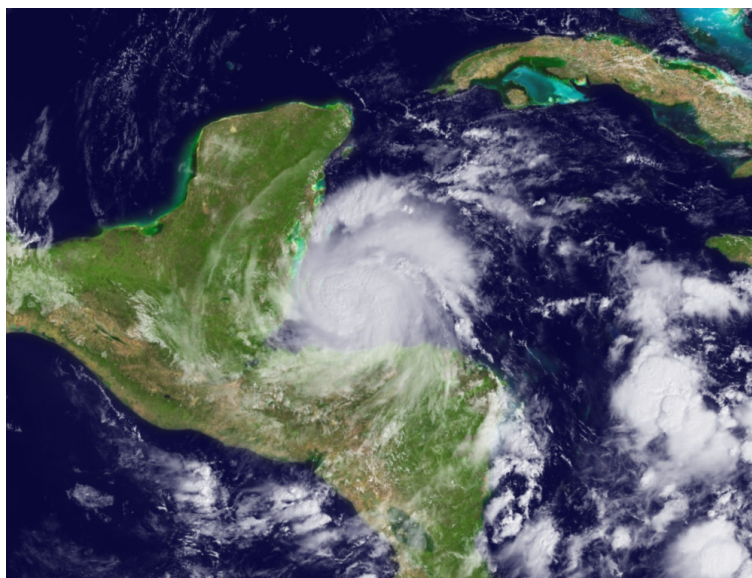
Joint Hurricane Testbed – Begun in 2001 under the USWRP, the JHT is a competitive, peer-reviewed, ongoing process to choose the best mature

Your feedback on this Newsletter would be appreciated, as would be suggestions for future stories and ways to make this communication venue most effective.

JHT Projects — Funding Update

The 12 projects for the new 5th Round of Joint Hurricane Testbed (JHT) funding began 1 August 2009. Quasi-operational testing and evaluation were conducted during the 2009 hurricane season by the points of contact and JHT staff working with the principal investigators. The PIs provided mid-year reports, presented the work in progress at the Interdepartmental Hurricane Conference in March, and provided a renewal proposal. Chris Landsea (NOAA/AOML) provided feedback on all 12 projects (along with feedback from some of the points of contact) to the JHT Steering Committee for consideration as they make renewal recommendations for the second year of funding. Of the 12 projects, 11 were continued for a second year of funding and testing during the 2010 hurricane season. (One project – the QuikSCAT based one – was discontinued due to both the demise of QuikSCAT and lack of transition capabilities with the current ASCAT.)

A draft Announcement of Federal Funding Opportunity for a 6th round of JHT projects was written and provided to the JHT Steering Committee in March 2010. Revisions based upon their comments were made and submitted to Roger Pierce (USWRP) for NOAA/DOC approval. The AFFO will hopefully provide \$1.25 million in funding for new projects and was released in July 2010. 30 qualified Letters of Intent were received and reviewed by the JHT Steering Committee.



Hurricane Richard makes landfall in Belize, October 25, 2010.

Of these 10 were recommended for putting in a full proposal. All 30 authors of the Letters of Intent were contacted and provided both the recommendation and some feedback on their concept.

– Chris Landsea, NOAA/NWS/NCEP/NHC

VORTEX2 May Unravel Mysteries Behind Tornadoes

Our quest for knowledge leads us to outer space and the depths of the ocean using spacecraft, ships and submarines. Flatbed trucks, mini-vans, and converted ambulances generally do not inspire one to think of epic scientific journeys. However, this spring, an armada of land-based research vehicles embarked on a historic expedition in the Great Plains to collect clues about the mysteries behind tornadoes.

More than 100 researchers and students assembled the largest collection of cutting-edge weather equipment in history for the NOAA and National Science Foundation-sponsored Verification of the Origins of Rotation in Tornadoes Experiment 2009-2010, or VORTEX2. Their mission was to cast a net of weather instruments around and under rotating thunderstorms in hopes of catching a tornado as it formed. The fieldwork arm of VORTEX2 is now complete and the hard work of data analysis is underway.

Why are Scientists All Spun Up About Tornadoes?

Like space and the sea, much of the atmosphere remains a mystery. A thunderstorm can be a massive monster climbing miles into the sky and stretching hundreds of miles across the land. How does such a beast begin to rotate? What causes it to concentrate its energy into a spinning whirlwind a fraction of the size of its source? What draws the funnel to the ground to destroy and, moments later, causes it to recoil upwards into the atmosphere? These questions are what drive researchers to solve the mysteries behind tornadoes.

VORTEX2 was designed so researchers could observe all the scales of motion from the thunderstorm down to the tornado.

“Understanding tornadoes means understanding the storm environment,” said Don Burgess, a retired NOAA research meteorologist who works part-time with the Cooperative Institute for Mesoscale Meteorological Studies in Norman, Okla., and a VORTEX2 Steering Committee member.

One use of VORTEX2 data will be to develop computer models that are so specific they can predict the behavior of individual thunderstorms and ultimately tornadoes.

“What VORTEX2 is trying to do is extend tornado warning lead times from the current 13 minute average to 30-50 minutes,” said Lou Wicker, also a VORTEX2 Steering Committee member and NSSL scientist.

Fast and Furious Tornado Research

VORTEX2’s modern day explorers roamed across nine states over a five-week period in the spring of 2009 and another six weeks in 2010. The nomadic fleet included 10 mobile radars, a remote control aircraft, weather balloons, instrumented vehicles, and vehicles equipped to drop instruments in the path of a storm.

Reflecting Back on a Whirlwind of a Research Tour

VORTEX2 teams have been home for almost two months now. Finally, there is time to reflect on the data collection phase of the project.

“Last year, we only got one [tornado], but the one we got was a very good one – a significant tornado,” said Burgess. “We encountered quite a number of smaller, short-lived tornadoes this year,” he added.

More Hard Work Ahead

In total, VORTEX2 researchers gathered data on at least 30 rotating thunderstorms (known as supercells) and 20 weak or short-lived tornadoes this year.

“These [smaller, short-lived tornadoes] are the most prevalent type of tornadic activity,” said Wicker. “And, they are the most difficult to forecast, detect and issue warnings for.”

Analysis of the vast amounts of data takes time, but its time well spent. “We’ll be looking at this data for five to 10 years,” Wicker said. “Two years from now we’re going to have a much better feel for what we’re going to learn from this experiment.”

– Susan Cobb, NOAA/NSSL



An instrument rack fixed to the top of a minivan measures temperature, pressure, humidity and winds during a VORTEX2 storm chase near Roswell, New Mexico on May 17, 2010. Credit: Derek Stratman, NOAA NSSL.

Did you know...

Although a swath of the Great Plains from Texas to Minnesota has long been dubbed Tornado Alley, the nation actually has several avenues of enhanced tornado risk, as highlighted in a new analysis by University of Akron graduate student Michael Frates. Frates identified four distinct clusters of action, located in the Plains, the Deep South, the Midwest, and the Carolinas.

– Courtesy, UCAR Magazine

Two Projects Extend HMT Findings on Atmospheric Rivers

Two projects led by the Earth System Research Laboratory (ESRL), the National Weather Service (NWS), and the California Department of Water Resources (CA-DWR) will help detect and monitor flood producing atmospheric rivers (ARs), narrow regions of enhanced water vapor transport in landfalling, midlatitude storms. First, CA-DWR is sponsoring a HMT legacy project that includes upgrading 32 existing Global Positioning System (GPS) receivers in California with meteorological data packages that will allow the receivers to measure integrated water vapor, a key ingredient of ARs and the fuel for generating precipitation. The existing GPS receivers are part of the Plate Boundary Observatory operated by the National Science Foundation to precisely monitor the position of the Earth's crust.

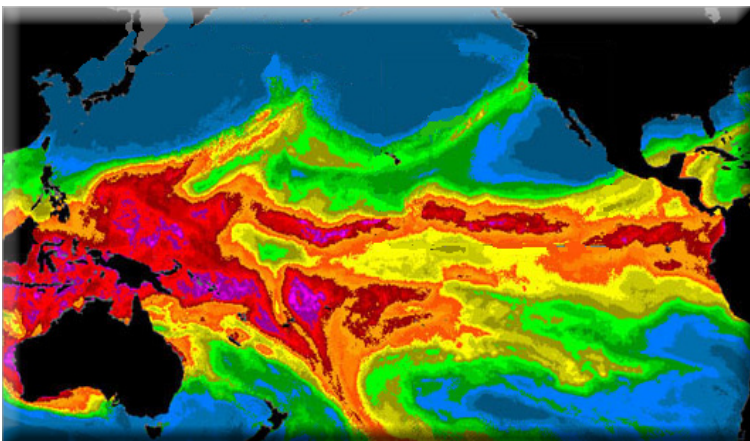
The second project is sponsored by NOAA's Coastal Storms Program (CSP) and will fund the NWS Pacific Region to deploy GPS receivers at nine key locations across the Pacific Basin, several of which will be within the breeding grounds of ARs. Data from these sensors and improved modeling through data assimilation will likely promote advanced detection of developing oceanic storms and signs of their

rapid development or weakening. The data from all of the GPS sites in California and across the Pacific will be made available to the public on the NOAA GPS Meteorology Program web page (<http://gpsmet.noaa.gov>) and to NWS operations through the Meteorological Assimilation Data Ingest System (MADIS).

In a maritime environment, a deep corridor of concentrated water vapor transport is often found in landfalling storms. These corridors are referred to as ARs because they tend to be quite narrow relative to their length scale and because they are responsible for almost all of the poleward water vapor transport. Consequently, ARs play a crucial role in the global water cycle and represent a key phenomenon linking weather and climate, yet until now, water vapor and its transport in ARs have not been adequately monitored in space and time by other observations.

Floods cause more damage nationwide than any other type of natural disaster. HMT-West has provided an opportunity for NWS hydrologists and meteorologists in California, Oregon and Washington to work closely with NOAA researchers to develop and evaluate new methods of monitoring and predicting ARs and their resulting impacts, including extreme precipitation that leads to floods. This work is important given the general expectation from climate models that extreme precipitation events will increase in a changing climate. To help guide climate model diagnostics, ongoing research in ESRL is focusing on explaining the origins of some of the strongest ARs, which can connect to the tropics, and is exploring the role of the Sierra Nevada's in modifying landfalling ARs. The GPS projects described here represent a major step forward in regional climate-related research and monitoring associated with the water cycle.

– Allen White, NOAA/ESRL



Recent WAS*IS Activities Organized by SIP



The Societal Impacts Program (SIP) implemented the first ever Weather and Society * Integrated Studies (WAS*IS) Caribbean workshop June 6-11 in San Juan, PR. The workshop was supported by NCAR SIP funds (including US-WRP funding), NCAR RAL Diversity Funds and funds from the NWS IAO/VCP initiative. The workshop brought together a diverse array of stakeholders from the Caribbean region, including forecasters, broadcasters, emergency managers, academics, and other public and private sector representatives for the purpose of pursuing integrated weather and society work. There were 23 participants from 12 countries, plus a number of other invited speakers, WAS*IS veterans, and outside observers.

SIP also hosted a Summer 2010 WAS*IS workshop August 5-13, 2010, in Boulder, Colorado. This summer, we had 28 invited participants from academia, government, and the private sector. For more information, see the WAS*IS website at: <http://www.sip.ucar.edu/wasis>.

SIP Survey in October

The Societal Impacts Program implemented a survey starting October 2010 to elicit the public's understanding, use, preferences, and value for current and improved hurricane information. The primary focus is to develop economic benefit estimates of potential improvements under the Hurricane Forecast Improvement Project. They are also more specifically exploring the public's understanding and need for storm surge information.



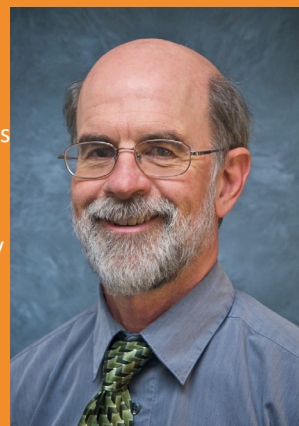
Damage caused by Hurricane Katrina

Dr. Stan Benjamin Selected as JCSDA Associate Director

Dr. Stan Benjamin has been appointed to the position of JCSDA Associate Director for NOAA's Office of Oceanic and Atmospheric Research (OAR). As a JCSDA Associate Director, he will represent OAR on JCSDA's Executive Team. Stan is currently Chief, Assimilation and Modeling Branch, Global Systems Division, NOAA Earth Systems Research Laboratory, in Boulder, Colorado. He is already quite familiar with JCSDA activities through his membership on JCSDA's Science Steering Committee. In his announcement of Stan's appointment, Col. Mark Zettlemoyer, Chair, JCSDA Management Oversight Board, stated that "Stan's background and current position as Chief of the Global Systems Division Assimilation and Modeling Branch make him a great fit."

Stan received his MS and PhD degrees in Meteorology from the Pennsylvania State University. At NOAA/OAR's Assimilation and Modeling Branch, he directed development of the Rapid Update

Cycle, an operational data assimilation/numerical forecast system running at the NWS National Centers for Environmental Prediction that provides analyses and short-range forecasts at high frequency (every 1hr) using synoptic observations. He is currently directing or co-directing development of several models: the global icosahedral isentropic atmospheric model (FIM – Flow-following finite-volume Icosahedral Model); the HRRR model (3km High-Resolution Rapid Refresh, updated hourly with radar reflectivity assimilation over US); and the WRF/GSI-based Rapid Refresh planned to replace RUC in early 2011.



Publications Round-Up

Coniglio, M. C., K. L. Elmore, J. S. Kain, S. J. Weiss, M. Xue, M. L. Weisman, 2010: Evaluation of WRF model output for severe weather forecasting from the 2008 NOAA Hazardous Weather Testbed spring experiment. *Wea. Forecasting*, 25, 408-427.

Darden, C.B., D.J. Nadler, B.C. Carcione, R.J. Blakeslee, G.T. Stano, and D.E. Buechler, 2010: Utilizing Total Lightning Information to Diagnose Convective Trends. *Bull. Amer. Met. Soc.*, 91, 167-175.

Kaplan, J., M. DeMaria, and J. A. Knaff, 2010: A Revised Tropical Cyclone Rapid Intensification Index for the Atlantic and Eastern North Pacific Basins. *Wea. Forecasting*, 25(1), 220-241.

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Lazo, J.K., D.M. Waldman, B.H. Morrow, and J.A. Thacher, 2010: Assessment of Household Evacuation Decision Making and the Benefits of Improved Hurricane Forecasting. *Wea. Forecasting*, 25(1), 207-219.

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Kain, J. S., M. Xue, M. C. Coniglio, S. J. Weiss, F. Kong, T. L. Jensen, B. G. Brown, J. Gao, K. Brewster, K. W. Thomas, Y. Wang, C. S. Schwartz, and J. J. Levit, 2010: Assessing advances in the assimilation of radar data and other mesoscale observations within a collaborative forecasting-research environment. *Wea. Forecasting*, 25, 1510-1521.

Schwartz, C. S., J. S. Kain, S. J. Weiss, M. Xue, D. R. Bright, F. Kong, K. W. Thomas, J. J. Levit, M. C. Coniglio, M. S. Wandishin, 2010: Toward improved convection-allowing ensembles: Model physics sensitivities and optimizing probabilistic guidance with small ensemble membership. *Wea. Forecasting*, 25, 263-280.



Recent & Upcoming Events

DTC Verification Workshop: 2-4 November 2010, Boulder, CO, <http://www.dtcenter.org/verification/workshops10/dtcworkshop2010.php>

DTC-HMT Project Update Meeting: 1 November 2010, Boulder, CO

HMT-West Annual Meeting: 6-8 October, 2010, Santa Rosa, CA, <http://hmt.noaa.gov/news/2010/102210.html>

DTC Science Advisory Board / Management Board Meeting: 21-23 September 2010, Boulder, CO

DTC Ensemble Testbed Workshop: 18-19 August 2010, Boulder, CO, http://www.dtcenter.org/events/workshops10/det_workshop/index.php

MET Tutorial: 5-6 August 2010, Boulder, CO

WRF Tutorial: 26-30 July 2010, Boulder, CO

1st GSI Tutorial: 28-30 June 2010, Boulder, CO, http://www.dtcenter.org/com-GSI/users/docs/presentations_2010.php

WRF Users Workshop: 21-25 June 2010, Boulder, CO

Testbeds at a Glance

NOAA Testbed Portal

<http://www.esrl.noaa.gov/research/uswrp/testbeds/>

Climate Testbed (CTB)

<http://www.cpc.noaa.gov/products/ctb/>

Developmental Testbed Center (DTC)

<http://www.dtcenter.org/>

Hazardous Weather Testbed (HWT)

<http://www.nssl.noaa.gov/projects/hwt/>

Hydrometeorology Testbed (HMT)

<http://hmt.noaa.gov/>

Joint Hurricane Testbed (JHT)

<http://www.nhc.noaa.gov/jht/>

Societal Impacts Program (SIP)

<http://www.sip.ucar.edu/>

Raindrops Keep Falling on my Disdrometer

ESRL partners with leading science museum to develop hands-on science exhibit

One overcast day in July, ESRL's David Kingsmill watched raindrops falling on the rainbow-colored umbrella he held. This was a decidedly unusual rainstorm, however. The drops were not falling from the sky, but from a "rain chamber" outside the Exploratorium in San Francisco.

Kingsmill (PSD) and ESRL colleagues are helping develop a new exhibit with the Exploratorium, an internationally acclaimed "museum of science, art and human perception."

Last year, NOAA signed on a five-year educational partnership to co-develop interactive exhibits, online learning experiences and professional development workshops for the learning institution.

"The Exploratorium provides a really good vehicle for delivering our message to the public," said Kingsmill. "People can literally get their hands on what we are doing at NOAA."

Shortly after the partnership was announced, Exploratorium staff visited ESRL, to learn more about NOAA science. Kingsmill and his colleagues wowed the museum's Mary Miller, Thomas Humphrey, and others with a laboratory demonstration of rain-measuring instruments used to study the connection between climate and weather in the water cycle.

The group began brainstorming how these instruments—and the science on which they are based—might be presented to the public in a unique and engaging way.

During the next few months, staff from the two institutions shared a flurry of ideas. The teams got to thinking, "While it's true that the weather can't be controlled in the real world, what about in a closet-sized exhibit?" The concept of a rain chamber was born.



The Exploratorium exhibit would employ rain gauges, which measure the volume of rain, and "disdrometers," which count individual raindrops and characterize their size and fall speed. Kingsmill consulted with exhibit fabricators on rain formation so that the rain produced by the chamber was realistic enough.

Another important part of developing the exhibit was demonstrating ESRL's equipment to Exploratorium visitors and staff, to determine their interests and their baseline level of scientific knowledge before figuring out what kinds of visual aids would be helpful in an exhibit. Kingsmill and Allen White (also PSD), spent time at the Exploratorium this summer doing just that.

Being right at the museum made it easy to test new ideas practically on the spot. For example, after conducting demonstrations of the instruments in one area of the museum, they realized that it made more sense to move them next to existing exhibits on fog and

raindrops to provide visitors with additional context.

"One of the great things about working at the Exploratorium was each day saying, 'How'd it go?' and 'What can we do differently?'" said Kingsmill.

The culminating demonstration of the summer was an evaluation on Sept. 15. Kingsmill used new prototype visuals and a tabletop version of the rain chamber to engage visitors. Exploratorium staff observed from a distance and then interviewed people as they left the area. One finding was

that most of the visitors could understand individual exhibits, but struggled to see how they were related to each other. That evaluation, and feedback from the other demonstrations, will help guide the development of a more permanent exhibit.

The rain chamber exhibit will continue to evolve for the next couple years as ESRL and the Exploratorium design complementary pieces to help tell the story of rain and explain the connection between scientific instrumentation and big issues such as flooding and climate change.

— Barb DeLuisi & Katy Human, NOAA/ESRL

Front Page Image: Courtesy, Wikimedia Commons (http://commons.wikimedia.org/wiki/File:Azules_de_Las_Tablas.jpg)

NOAA Testbed news is a publication from the NOAA USWRP Executive Committee: Bob Atlas, Don Berchhoff, Al Powell, and Marty Ralph (Chair)

Please send meeting notices, news story ideas, and suggestions to the Editor, Janet.Intrieri@noaa.gov

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<http://www.uswrp.org>

